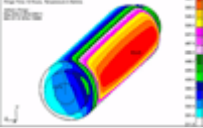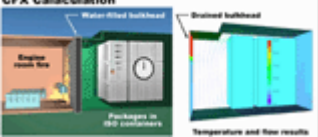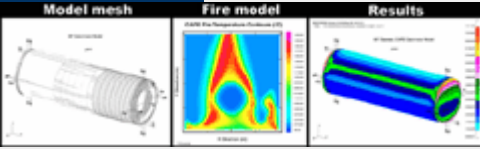# Thermal Analysis

Thermal analysis is the study, calculation, and interpretation of problems in which temperature or its effect is of interest. An example of this kind of a problem could be the determination of how long it takes for the center of an object to get to a certain temperature or what is the temperature at a specific location within the object after it is been exposed to a fire for a period of time. Through thermal analysis we can also quantify the amount of energy transfer during thermal processes like the ones mentioned above as well as characterize how an object reacts when exposed to different thermal environments.

Patran/P-Thermal thermal analysis code

Description	Applications	Example
• Patran is a mesh (model) generator • P-Thermal (Qtran) is a commercial resistor-capacitor network code	• NUREG 0170 rework • Modal study revision • CLWR Tritium study • Package design (ONC, EONC, BUSS Cask) • Modeling for web sites, communications with "stakeholders" (SAF-T) proposal Tractor/Trailer thermal design analyses • Design of calorimeter for sensitivity analysis for flash tube NDT applications	Click to view picture

CFX computational fluid dynamics code

Description	Applications	Example
• Calculates fluid flow, conduction and radiation simultaneously • Calculates convection heat transfer from flow solution • Conduction capabilities are limited	• Ship fire scenarios (SeaRAM and JNC) • Modal study revision • Spent fuel rod bundles: modal study rework • 3-D pool fire modeling • Risk studies	Click to view picture

Container Analysis Fire Environment (CAFE) model

Description	Applications	Example
• Provides realistic fire boundary conditions based on first principles • Is a set of user routines integrated with P-thermal commercial code • Can run cases in a few hours	• Package design analysis • Risk studies - NUREG 0170 revision, modal study revision, etc. • Public communications (fire graphics) • Experiment design (University of Nevada, Reno collaboration)	Click to view picture

Sandia One-Dimensional Direct and Inverse Thermal (SODDIT) code

Description	Applications	Example

- Inverse solution: solves for boundary conditions given interior temperature history

- Allows estimation of surface heat transfer in experiments

- Estimating fire conditions from instrumented Type B packages

- Estimating heat transfer to simulated packages for research (UNR collaboration, SeaRAM experiments)

Click to view picture

SODDIT Inverse Heat Conduction

For further information, see http://www.sandia.gov/tp/tp.htm